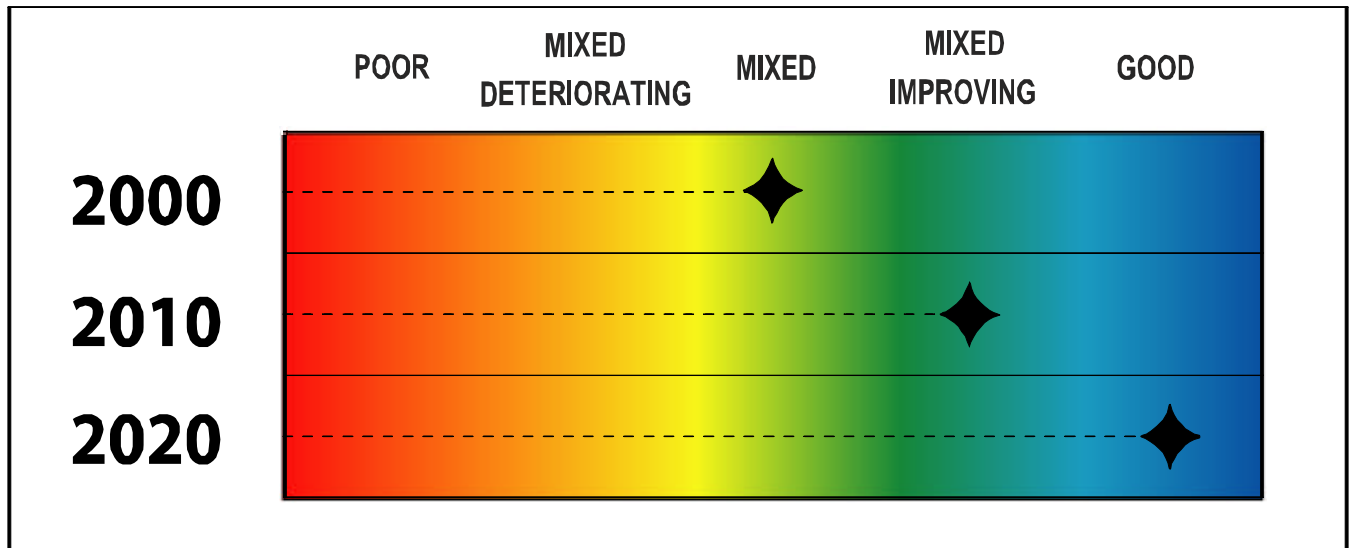


Subgoal 11

Do we have enough information, data, understanding, and indicators to inform the decision-making process?



Status

Some information sources are available to support Lake Michigan decision-makers, but there is a need to better collate, coordinate, and interpret existing data in addition to gathering more data and developing new indicators are needed to address complex management issues. Numerous monitoring programs and activities are currently underway in the Lake Michigan basin at the federal, state, county, municipal, and watershed levels. These programs monitor water quality, sediments, fish, air quality, and habitat. They involve collecting chemical, microbiological, fish and wildlife, physical characteristic, land use, and other environmental data.

The Lake Michigan LaMP has also begun identifying indicators to guide these monitoring efforts. If the environmental indicators identified by the Lake Michigan LaMP are to support future management decisions, they must be adopted by monitoring programs basinwide and used to guide sampling and assessment parameters and media. Over the last 2 years, efforts have been undertaken to gather data on wetlands, beaches,

stream buffers, and other items that will ensure that the goal status changes from mixed to mixed/improving by 2010 and to good by 2020. The following section describes these data collection efforts.

Challenges

- To expand Lake Michigan basin monitoring collaboration and coordination by promoting data comparability and joint planning and to deliver efficient and timely reporting on the status of the Lake Michigan ecosystem.
- To leverage the 1994-95 Lake Michigan Mass Balance sampling with a 2005 Lake Michigan intensive and coordinated effort.

Coordination of Monitoring

The Great Lakes Water Quality Agreement requires that LaMPs "include a description of surveillance and monitoring to track the effectiveness of remedial measures and the eventual elimination of the contribution to impairments of beneficial uses..."

Monitoring collaboration and coordination need to be maximized in order to promote data comparability, enhance data utility, extend resources and deliver efficient and timely reporting on environmental change and progress as measured by Lakewide Management Plans (LaMPs) and State of the Lakes Ecosystem Conference (SOLEC) indicators.

Responsibility for monitoring in the Great Lakes is divided among a vast number of program and agencies throughout the basin. While these monitoring efforts meet individual program needs and mandate, the lack of consistency in protocols and methodology limits the usefulness of the resultant data for sharing, comparing and opportunities coordination might provide. The Binational executive Committee (BEC) sponsors two frameworks for developing indicators and reporting on the status of the Great Lakes ecosystem: LaMPs and The State of the Lakes Ecosystem Conference (SOLEC)..

BEC requested agencies to investigate opportunities to enhance monitoring coordination and prepare a status report for the BEC Spring 2002 meeting and a set of options for the Fall 2002 meeting. A series of workshops were conducted to develop a draft proposal which is being refined.

Lake Michigan Intensive Sampling Year

The Lake Michigan LaMP Technical Coordinating Committee and the Lake Michigan Monitoring Coordinating Council's (LMMCC) broad-based membership are leading a collaborative effort to extensively sample the lake in 2005. The resulting data, when compared with the 1994-95 data reports would provide key trend data.

The LMMCC is taking the lead in planning and coordination. One outcome of this effort is to also help the Lake Michigan AOCs with their data needs.

GLNPO's Aquatic Contaminant Monitoring Program

GLNPO is responsible for monitoring the water quality of the Great Lakes. GLNPO has been collecting data on levels of persistent bioaccumulative toxic (PBT) substances in air and fish since 1990 and the 1970s, respectively. Many PBTs have the potential to increase the risk of cancer, birth defects, and neurological and developmental problems through long-term, low-level exposure. These pollutants can enter the Lakes in significant quantities from the air and subsequently build up in fish, which results in limits on consumption of Great Lakes fish. Data complementary to the air and fish data is needed for the water so that EPA can accurately estimate the net amount of these pollutants that are being put into the lakes from the air and to determine how high levels are in fish relative to the levels in the water. Levels in fish can be millions of times higher than in the water itself. EPA monitored these contaminants in the past and will start again for Lake Michigan this year.

The following chemicals will be monitored:

- Polychlorinated biphenyls (PCBs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Organochlorine pesticides including DDT and toxaphene
- Dioxins and furans
- Mercury and methylmercury
- Polybrominated diphenyl ethers (PBDEs) (flame retardants used in materials and plastics)
- Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (from a waterproofing product now off the market)

Lake Michigan Tributary Monitoring Project

The Great Lakes Commission developed an inventory of monitoring programs in the Lake Michigan drainage basin. This project has resulted in two major projects. The Lake Michigan Tributary Monitoring Project report (<http://www.glc.org/monitoring/lakemich/>) was

Lake Michigan Monitoring Coordinating Council

The Lake Michigan Monitoring Coordinating Council was established to enhance coordination, communication, and data management among agencies and other organizations that conduct or benefit from monitoring efforts in the Lake Michigan basin in the interest of supporting the Lake Michigan LaMP.

The Council has 31 members representing federal, state, tribal, and local governments, nonprofit watershed groups, and other environmental organizations, educational entities, and the regulated community. The Council meets twice each year in locations throughout the watershed. Council meetings, biennial conferences, and feedback from constituents shape the Council's work plan and activities. The Council will develop goals, each with an active working group, whose broad membership will expand the core Council membership.

In 1999, four short-term working groups were created to develop information to move the Council forward: Data Inventory and Analysis; Monitoring Objectives; Watershed Pilots; and Outreach and Collaboration. The progress of those short-term working groups set the stage for the development of a new Council operating framework in 2001.

The new Council framework has been developed to increase coordination between appropriate monitoring entities, allow the development of a strategic plan for monitoring, and add value to the individual efforts of the Council's member organizations. The new Council framework takes advantage of the logical interactions between the various resource-based monitoring entities and other affected stakeholder groups.

The working groups formed under this new framework will build on the efforts to coordinate monitoring within individual resources by groups such as the Lakewide Management Plan Committees, the Wisconsin Groundwater Coordinating Council, and the Great Lakes Fishery Commission. Each of these resource-based working groups will coordinate existing monitoring networks around several common considerations: monitoring objectives; spatial, temporal and parameter network design; methods comparability; quality assurance and control planning; database sharing; and data analysis approaches. Currently, an ANS basin survey is being completed.

developed after the initial inventory and includes a detailed review of programs in each of ten subwatersheds, along with an analysis of gaps and recommendations for further initiatives. Please see the report for detailed information about the inventory process.

The second result of this project is the interactive monitoring inventory database. Through the inventory information about monitoring programs (or "metadata") was collected and a database was designed for long-term storage and access. One aspect of program metadata is information about the geographic area covered by each monitoring program. For many programs, we were able to obtain information on fixed monitoring stations. These stations and other geographic descriptors (such as watersheds, counties, etc) can now be searched through this website, and all the metadata about those programs can be viewed.

Wetland Monitoring

The Great Lakes Coastal Wetlands Consortium was formed in 2000 to develop a long-term, binational, coastal wetland monitoring program. The Consortium is composed of a multi-organizational Project Management Team. Consortium progress thus far includes: the mapping and classification of all coastal wetlands (will be completed June 2004), pilot studies to demonstrate monitoring protocols for coastal wetland indicators, and an upcoming report on the status of coastal wetlands at the October 2004 SOLEC.

One of the pilot studies conducted by the Consortium took place in five northern Lake Michigan coastal wetlands: Ogontz, Nahma, St. Ignace Bridge, Escanaba, and Ludington Park. The objectives of the pilot study were to evaluate the performance and test the robustness of a preliminary Index of Biotic Integrity (IBI); identify and eliminate any problems and make improvements to the IBI where necessary; test the applicability of the IBI in similar wetlands of Lake Michigan; and, establish stressor - ecological-response relationships that could be used to manage high quality wetlands and restore degraded ones. Over the next two years, the

Great Lakes Wetlands Consortium

On November 29, 2000, EPA's GLNPO awarded a cooperative agreement to the Great Lakes Commission for the first large-scale, binational, collaborative effort to assess the ecological health of Great Lakes coastal wetlands. A consortium brought together by the Great Lakes Commission will (1) design and validate indicators to assess the ecological integrity of Great Lakes coastal wetlands; (2) design an implementable, long-term program to monitor Great Lakes coastal wetlands; and (3) create and put coastal wetland data in a binational database accessible to all scientists, decision-makers, and the public. GLNPO has contributed \$400,000 to the effort, and the other consortium members are contributing over \$200,000. The consortium currently includes Great Lakes wetland scientists and resource managers from the U.S. and Canadian federal governments, states and provinces, nonprofit organizations, and academia. Similar funding levels are expected for each of the next 2 years. The award is premised on the recognized need to assess the health of Great Lakes coastal wetlands, which are an integral part of the Great Lakes basin ecosystem. Coastal wetlands have critically important ecological values and functions, yet little basin-wide data is available for assessing their ecological health. For this reason, a suite of 13 Great Lakes coastal wetland indicators was presented at SOLEC 1998. An assessment of five of these indicators was presented at SOLEC 2000 in Hamilton, Ontario. The consortium's work will expand the monitoring and reporting capabilities of the United States and Canada under the GLWQA. For additional information, contact Karen Rodriguez of

Consortium will be working with state/provincial, tribal, and private landowners to develop a long-term monitoring program involving Lake Michigan sites representative of coastal wetland types.

At the southern end of the Lake, work is progressing on assessing the extent of invasive plant species in interdunal wetlands of the Indiana Dunes National Lakeshore and State Parks. These special wetlands are highly vulnerable to invasives such as purple loosestrife and *Phragmites*. Park staffs are working with The Nature Conservancy, Save the Dunes Council, and Shirley Heinze Trust Fund to formulate a control program that will eliminate invasives and protect the native plant species.

A Biodiversity Blitz was held in the Calumet Region of Chicago in August 2002. This 24-hour inventory of species involved more than 130 scientists for the purposes of establishing a user-friendly database,

and launching community-based wetland conservation initiatives. A total of 2,257 species at wetland, prairie and woodland sites were recorded during the Blitz. The City of Chicago is working with many groups to develop a design for the recovery of the region's wetlands, survivors of the industrialization of the region.

Great Lakes National Park Monitoring

Two national parks in the Lake Michigan basin are participating in a Great Lakes Network made up of 9 national park units from four states in the Great Lakes region. These parks extend from Minnesota to Indiana. The Sleeping Bear Dunes and the Indiana Dunes National Lakeshore are working as a unit for monitoring, fostering the exchange of information and resources between parks with similar issues, reducing per park costs through multi-park studies and providing network-based expertise that would not be affordable to the parks individually. The overall purpose is to develop broadly-based scientific data on current status and long-term trends in composition, structure, and function of the parks' ecosystems.

Lake Michigan Online

Lake Michigan Online Atlas

The Lake Michigan Online Atlas provides Internet access to a number of information resources related to the Lake Michigan basin. Reference maps offer an overview of the region. Computer-compatible data layers can be downloaded for use in a geographic information system (GIS). Hyperlinks and contact information improve access to regional resources. And an online mapping tool allows internet users to explore data and create custom maps using a web browser. More information is available at <http://mapserver.glc.org/website/atlas/viewer.htm>.

Lake Michigan Watershed Academy sessions have indicated a great deal of interest in research, decision making, data creation and mapping in the Lake Michigan basin. The list of interested people includes staff at many of the agencies and organizations active in the region, local governments, researchers, residents and students. For many of these people, a central

coordinating point for mapped information about the region is a valuable tool. Access to overview information and to resources already developed can significantly enhance their work or understanding of a topic. A central point from which to share data may help them reach a broader audience. And improved awareness of regional resources, issues and active players may lead to better cooperation, more focus and new directions.

Great Lakes GIS

The Great Lakes Fishery Commission is developing an aquatic atlas in GIS format that pulls together data from the Lake Michigan Mass Balance studies, historical sediment surveys, coastal wetland data as well as dam databases to facilitate a holistic approach to managing the Great Lakes basin. These layers of aquatic habitat information will compliment the current on-line atlas work of the Great Lakes Commission.

A GIS database should, for the first time, allow the integration of data developed by the numerous U.S. and Canadian agencies responsible for conserving this system. In addition to integrating existing data from federal, state, provincial, tribal, and non-governmental organizations, this information system will also provide a means of inventorying and monitoring basin habitat (e.g. terrestrial, tributary, nearshore, and offshore systems)..

The primary objective of this project is to integrate data from across each lake basin into a common database to provide an inventory of basin-wide aquatic resources. Additionally, many new layers and tools are also being developed to ensure that the DSS is a powerful tool for analysis of whole-system responses to management alternatives. More information is available at <http://www.glfcc.org/glgis>.

Environmental Indicators

The Lake Michigan LaMP promotes use of environmental indicators to track progress in achieving the LaMP goals. For a list of potential indicators, see Chapter 3 of LaMP 2000. The concept of environmental indicators is not new.

State and federal agencies have used indicators to track trends in environmental health, particularly fish population trends and to help guide management decisions. Effective use of the LaMP indicators will link actual environmental responses directly to programs and activities.

The LaMP indicators are environmental, social, and economic measures used to assess the achievement of LaMP goals and objectives. These indicators will demonstrate improvements in and protection of the Lake Michigan ecosystem and will function as an early warning system to identify pressures on the ecosystem. The indicators will measure conditions such as ecosystem integrity, aquatic health, human health, and the quality of life. Work on Lake Michigan specific indicators has slowed pending the outcome of a number of projects on the same issue.

State of the Lakes Ecosystem Conferences

Additional work has been completed on the indicators over the past 2 years through the State of the Lakes Ecosystem Conference (SOLEC) process. The SOLEC is hosted biennially by U.S. EPA GLNPO and Environment Canada. The last SOLEC was held in October 2002 in Cleveland, Ohio. The next conference will be held in Toronto, Ontario, in October 2004. The conferences are intended to provide a forum for exchange of information on the ecological condition of the Great Lakes and surrounding lands. A major goal is to bring together a large audience of government (at all levels), corporate, and not-for-profit managers to discuss problems that affect the lakes. The conferences have led to information gathering by a wide variety of agencies and organizations. In the year following each conference, a State of the Great Lakes Report is prepared by the governments based on the conference itself and on extensive public comments following the conference.

Lake Michigan Monitoring Assessment

The Great Lakes Commission, in partnership with EPA and the Lake Michigan Monitoring

Coordinating Council, issued a report on Lake Michigan monitoring in October 2000. The report provides a comprehensive review of monitoring programs at the federal, state, and local levels for targeted watersheds; an analysis of gaps, inconsistencies, and unmet needs; an assessment of the adequacy of existing efforts to support critical ecosystem indicators; and recommendations for addressing major monitoring needs, particularly those considered most important for lakewide management decision-making. The study focused on monitoring in Grand Traverse Bay, White Lake, Muskegon Lake, the Grand River, the Kalamazoo River, the St. Joseph River, the Grand Calumet River, Waukegan Harbor, the Milwaukee River and Estuary, the Sheboygan River, the Fox-Wolf River Basin, Door County, the Menominee River, the Manistique River, and the open waters of Lake Michigan.

The report outlines a series of recommendations for improving monitoring in Lake Michigan. These recommendations are having a broader impact as organizations and governments in the United States and Canada are beginning work on better coordinating the Great Lakes systemwide monitoring strategy.

BEACH Monitoring

EPA initiated the Beaches Environmental Assessment, Closure, and Health (BEACH) program to strengthen individual beach programs and water quality standards, better inform the public, and promote scientific research to further protect the health of people who use beaches. EPA is improving laboratory testing methods for detecting contaminants at beaches and is assisting local governments in monitoring beach water quality. The Great Lakes Commission is pilot-testing a program for communicating the results of the National Beach Survey, assessing the consistency of beach closures with restriction advisories, and creating maps that connect with the national BEACH effort.

Integrated Atmospheric Deposition Network

U.S. EPA is a participant in the Integrated Atmospheric Deposition Network (IADN),

established in July 1988, by the Atmospheric Deposition Monitoring Task Force of the International Joint Commission. The objective of IADN is to acquire sufficient, quality-assured data to estimate the loading to the Great Lakes Basin of selected toxic substances. The relative importance of the atmospheric pathway can then be ascertained and appropriate control strategies developed.

Air Deposition Monitoring

During the 1999-2001 priority work cycle, the International Air Quality Advisory Board (IAQAB) and the Great Lakes Science Advisory Board (SAB) held two workshops, in cooperation with the Delta Institute and the Lake Michigan Forum, focusing on the capability of atmospheric models to support the development of policies, including source control strategies, by confirming deposition trends and identifying significant sources of persistent contaminants.

At the workshops, presentations from leading researchers and modelers were followed by discussion of the policy implication of their work. Participants included representatives of municipal, state and provincial governments, the U.S. and Canadian governments, universities, consultants, industry and environmental group. A Task Force has been formed in response to the many recommendations.

The Ann Arbor Statement

In September 2003, a group of over 70 scientists and policy makers met in Ann Arbor, Michigan, to discuss the long-range atmospheric transport of persistent, bioaccumulative and toxic substances (PBTs) to the Great Lakes Basin. This meeting was entitled "The Great Lakes Binational Toxics Strategy Long-Range Transport Workshop: The Atmospheric Pathway of Toxic Substances to the Great Lakes."

The Delta Institute developed the Ann Arbor Statement based on the proceedings of the workshop. The Statement recommends actions to better understand and reduce the impacts of the long-range transport of these chemicals. The Ann Arbor Statement is summarized below. To view the Statement in its entirety, visit www.delta-institute.org

The Ann Arbor Statement recognizes that, while considerable progress has been made in decreasing contamination in the Great Lakes Basin, PBTs remain at levels that pose threats to human and ecosystem health. Long-range atmospheric transport, at the regional, continental, hemispheric, and even global scale, is a significant contributor of some of these pollutants, and unless long-range transport issues are addressed, the Great Lakes Water Quality Agreement (GLWQA) goal of virtual elimination will not come into reach. There remain important gaps and uncertainties in our scientific understanding of the sources and the transformation and transport processes that control the environmental levels of PBTs. Resolving these scientific uncertainties is required for making wise policy decisions to further reduce pollutant concentrations, exposures and impacts. The discussion and deliberation in Ann Arbor resulted in a set of recommended actions to improve long-range transport science and to better inform policy. These actions, which are presented in the Ann Arbor Statement as some 60 specific research needs, fall into four categories (see box).

Next Steps

- Monitoring and research will be reviewed to identify LaMP pollutants.
- A LMMB Study data report has been or will be prepared for each contaminant studied and added to the LaMP 2000 online as available.
- Progress will be made in aligning monitoring programs and indicators.
- The coordinated monitoring plan for the lake intensive monitoring year 2005 will be finalized.
- Lake Michigan models will be documented further, and additional scenarios will be simulated with results shared through the LaMP and in other ways.
- Complete LMMCC ANS monitoring survey results and recommendations.
- Cladophora alga research and development needed.

Ann Arbor Statement Proposes Actions

Emissions Inventories

Canada and the United States must improve, coordinate and disseminate, in a more timely fashion, emissions and usage inventories of PBTs. Priority actions include standardizing estimation techniques, characterizing poorly understood sources, and improving the review and accountability of inventories. These efforts must be coordinated not only within the Great Lakes Basin but also on a continental and even global scale with the assistance of continental and international organizations.

Monitoring

Improved coordination, harmonization of chemicals and methods, effective data sharing, and enhanced data analyses must become immediate priorities for PBT monitoring. The successful Integrated Atmospheric Deposition Network (IADN) program should continue with a focus on these and other priorities including improved expert review, inclusion of emerging substances of concern, more timely dissemination of results, and incorporation of new and emerging technologies such as passive air samplers. Stations should also be set up to monitor inter- and intra-continental transport to and from the Great Lakes watershed basin.

Modeling

The full benefits of emission inventories and monitoring can only be realized if the results are used in modeling assessments which seek to: establish a complete mass balance or budget; calculate rates of transport to and from the Great Lakes basin; identify sources and/or source regions responsible for transport to the basin; and understand cross-media fluxes between air, water, soils, sediments and biota. Uncertainties regarding mercury must receive focused attention. Furthermore, an international modeling initiative is required in which various modeling approaches are tested, compared and coordinated and the findings presented to the lay public in a compelling and understandable format.

Integration and Synthesis

In order to fill the knowledge gaps and more efficiently use existing resources, future efforts should focus on coordinating emissions inventory, monitoring, and modeling efforts and improving accessibility and comparability of data and methods. International scientific cooperation is critical, as is support from stakeholder groups, including non-government organizations, academic institutions, and industry. Long-term funding commitments are necessary to improve our scientific understanding of the long-range transport of PBTs. To secure the required funding, scientists must work together to effectively communicate to the general public the linkages between understanding long-range transport and protecting public health and environmental quality.

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